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SUBJECT: NUCLEAR TEST BAN TECHNICAL TALKS:
US DELEGATION JOINT DRAFT REPORT OF JUNE 20

THE TEXT OF THE DRAFT JOINT REPORT PREPARED BY THE US DELEGATION AND HANDED TO MOROKHOV ON JUNE 20 FOLLOWS. (FULL REPORT ON STOESSEL/MOROKHOV CONVERSATION IS BEING SENT SEPTEL.) BEGIN TEXT.

AGREED CONCLUSIONS

THE U.S. AND SOVIET DELEGATION EXPERTS AGREE ON THE FOLLOWING TECHNICAL CONCLUSIONS RESULTING FROM THEIR DISCUSSIONS:
MONITORING A THRESHOLD CAN BE DONE PRIMARILY THROUGH THE USE OF SEISMIC METHODS. THE ACCURACY WITH WHICH THIS CAN BE DONE WILL DEPEND UPON CHARACTERISTICS OF SEISMIC MONITORYING NETWORKS WHICH MIGHT BE EMPLOYED, AND UPON THE AMOUNT AND TYPE OF SUPPLEMENTARY INFORMATION AVAILABLE ABOUT THE TEST SITES WHICH ARE USED, AS DISCUSSED SUBSEQUENTLY.

THE VIEWS OF BOTH THE US AND THE SOVIET SCIENTIFIC EXPERTS ON THE TELESEISMIC CHARACTERISTICS OF SEISMIC WAVES FROM UNDER-GROUND NUCLEAR EXPLOSIONS, AND ON THE CHARACTERISTICS OF THE SEISMIC NOISE BACKGROUND IN THE EARTH, ARE GENERALLY SIMILAR. THIS, IN TURN, LEADS TO SIMILAR VIEWS ON THE CHARACTERISTICS OF SEISMIC SENSORS WHICH SHOULD BE USED FOR MONITORING UNDERGROUND
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NUCLEAR EXPLOSIONS. HOWEVER, THE RESPONSE CHARACTERISTICS AC-

TUALLY BEING USED AT THE PRESENT TIME DIFFER SOMEWHAT, WHICH CONTRIBUTES TO CURRENT DIFFERENCES IN MAGNITUDE ESTIMATES ON A GIVEN SEISMIC EVENT.

THE DESIGN OF SEISMIC MONITORING NETWORKS WAS DISCUSSED BY BOTH DELEGATIONS. IT WAS GENERALLY AGREED THAT THE CAPABILITIES AND LIMITATIONS OF SUCH NETWORKS ARE PRIMARILY DETERMINED BY THE NUMBERS AND DISPOSITION OF SEISMIC STATIONS RELATIVE TO THE REGIONS TO BE MONITORED, BY THE KIND OF INSTRUMENTS EMPLOYED, AND UPON THE EFFECTIVE NOISE LEVELS AT THE STATIONS AFTER NOISE REDUCING METHODS HAVE BEEN EMPLOYED. AS REGARDS ABILITY TO MONITOR A YIELD THRESHOLD, IT WAS UNDERSTOOD THAT THE GREATEST ACCURACY IN DETERMINING THE LOCATION OF EXPLOSIONS ON A TEST SITE, AND THE MINIMUM ERROR IN DETERMINING MAGNITUDE AND HENCE YIELD, WOULD BE ACHIEVED BY NETWORKS CONTAINING NUMBEROUS WIDELY DISTRIBUTED PRECISION, WHICH CAN BE PARTIALLY COMPENSATED FOR IF PROPERLY CALIBRATED BY EXPLOSIONS.

METHODS USED BY SOVIET AND US SEISMOLOGISTS FOR ESTIMATING SEISMIC MAGNITUDE ARE SIMILAR, BUT NOT IDENTICAL. IN COMBINATION WITH THE DIFFERENCES IN INSTRUMENT RESPONSE CHARACTERISTICS PREVIOUSLY NOTED, THESE DIFFERING METHODS WOULD GENERALLY LEAD SOVIET SEISMOLOGISTS TO A HIGHER ESTIMATE OF MAGNITUDE THAN THAT OBTAINED BY US SEISMOLOGISTS. THIS SYSTEMATIC DIFFERENCE COULD BE COMPENSATED FOR ON THE AVERAGE, BUT IN THE CASE OF INDIVIDUAL EXPLOSIONS, DIFFERENCES OF A FEW TENTHS OF A MAGNITUDE UNIT COULD BE EXPECTED AS LONG AS DIFFERENT NETWORKS OF SEISMIC STATIONS ARE USED DUE TO AMPLITUDE SCATTER ALONG THE DIFFERENT PROPAGATION PATHS.

IN SPITE OF DIFFERENCESIN MAGNITUDE ESTIMATES, BOTH US AND SOVIET SEISMOLOGISTS HAVE ESTABLISHED CORRELATIONS BETWEEN SEISMIC MAGNITUDE AND YIELDS OF EXPLOSIONS ON THEIR OWN TEST SITES. USING THESE EXPLOSIONS FOR CALIBRATING VARIOUS GEO-PHYSICALLY DISTINCT UNITS OF THE TEST SITES, BOTH CAN ESTIMATE YIELDS OSFOTHER EXPOLSIONS IN THE SAME UNIT FROM SEISMIC DATA WITH AN ACCURACY WHICH IS LIMITED CHIEFLY BY THE DEGREE TO WHICH THEY UNDERSTAND CHARACTERISTICS OF THE ROCK IN THE VICINITY OF THE EXPLOSION AND BY NATURALLY OCCURRING VARIABILITY OR SCATTER OF SEISMIC WAVES AS THEY TRAVEL THROUGH THE EARTH. THE ESTIMATES OF YIELD FOR EXPLOSIONS AT UNCLAIBRATED TEST SITES, OR IN TYPES OF ROCKS IN WHICH EXPLOSIONS HAVE NOT PREVIOUSLY OCCURRED, ARE SUBJECT TO SUBSTANTIALLY LARGER ERRORS.

THE DEPTH AT WHICH AN EXPLOSION TAKES PLACE CAN INFLUENCE

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THE AMPLITUDE OF THE SEISMIC SIGNALS, AND HENCE THE ESTIMATED YIELD. IF THE EXPLOSION IS DEEP ENOUGH TO PERMIT RECOGNITION OF THE SEISMIC WAVES REFLECTED FROM THE EARTH'S SURFACE ABOVE THE SHOTPOINT, THEN THE YIELD ESTIMATE MAY BE CORRECTED TO ELIMINATE THE DEPTH EFFECT. FOR EXPLOSIONS WHICH TAKE PLACE NEAR THE MINI-MUM DEPTH FOR CONTAINMENT, HOWEVER, THE DEPTH MAY NOT BE DETER-MINABLE FROM THE TELESEISMIC DATA. KNOWLEDGE OF THE DEPTH IS ESPECIALLY IMPORTANT FOR EXPLOSIONS USED TO CALIBRATE A TEST SITE.

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SEVERAL EXPLOSIONS WHICH ARE DETONATED NEARLY SIMULTANEOUSLY, AND WHICH ARE SEPARTED FROM ONE ANOTHER BY ONLY A FEW KILOMETERS, WOULD PRODUCE SEISMIC WAVES WHICH AT LONG RANGES WOULD APPEAR TO BE FROM A SINGLE EXPLOSION. IN SUCH CASES, THE YIELD ESTIMATED FROM SEISMIC DATA WOULD BE THAT THE SUM OF THE INDIVIDUAL EXPLOSION YIELDS.

CALIBRATION EXPLOSIONS ON A TEST SITE MAY SERVE TO IMPROVE LOCATION ACCURACY AS WELL AS YIELD ACCURACY. IF THE LOCATION OF AT LEAST ONE LARGE CALIBRATION EXPLOSION IS ACCURATELY KNOWN, THEN THE LOCATIONS OF SUBSEQUENT EXPLOSIONS MAY BE DETERMINED WITHIN 1 OR 2 KILOMETERS OUT TO DISTANCES OF ABOUT 10 KILOMTERS FROM THE CALIBRATION EVENT.

II. DATA REQUIREMENTS

US THE SOVIET DELEGATION EXPERTS AGREE ON THE FOLLOWING DESCRIPTION OF THE DATA WHICH EACH SIDE SHALL PROVIDE FOR EACH PROPOSED TEST SITE IN ORDER TO ALLOW ADEQUATE VERIFICATION OF A YIELD-THRESHOLD.

DEFINE TEST SITE

AN ADEQUATE DEFINITION OF THE LOCATION OF EACH TEST SITE AND THE GEOGRAPHICAL COORDINATES OF ITS BOUNDARIES. (FOR PURPOSES OF THIS REPORT A TEST SITE SHALL BE CONSIDERED A CONTIGUOUS AREA IN WHICH NUCLEAR EXPLOSIONS ARE CARRIED OUT.)

GENERAL GEOLOGY

A 1:50,000 GEOLOGICAL MAP OF THE ENTIRE TEST SITE AND ADEQUATE GEOLOGICBZ CROSS-SECTIONS IN ALL AREAS OF THE TEST SITE WHERE NUCLEAR EXPLOSIONS WILL BE DETONATED.

STRATIGRAPHY

GENERALIZED STRATIGRAPHIC SECTIONS OF THE LAYERED SEDIMENTARY AND VOLCANIC ROCKS ON THE TEST SITE, GIVING FORMATION NAMES, AGES, PETROLOGIC DESCRIPTION AND GENERAL PHYSICAL PROPERTIES INCLUDING DENSITY, POROSITY AND SEISMIC VELOCITY

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OF THE ROCK UNITS.

WATER TABLE

AN ADEQUATE MAP SHOWING THE DEPTH TO THE GROUND-WATER TABLE FOR ALL AREASPOF THE TEST SITE WHERE NUCLEAR EXPLOSIONS WILL BE DETONATED IN THE FUTURE, AND AN ADEQUATE MAP SHOWING DEPTH OF PERMAFROST IF IT EXISTS.

COUPLING CHARACTERISTICS OF POTENTIAL TESTING MEDIA

THREE-DIMENSIONAL DESCRIPTIONS OF ALL GEOPHYSICALLY DISTINCT ROCK UNITS IN AREAS WHERE NUCLEAR EXPLOSIONS WILL DETONATED IN THE FUTURE. BY GEOPHYSICALLY DISTINCT ROCK UNITS WE MEAN EITHER SINGLE, MASSIVE PETROLOGICAL UNITS OR LAYERED-ROCK UNITS, WITHIN WHICH THE PHYSICAL CHARACTERISTICS WHICH AFFECT SEISMIC COUPLING ARE APPROXIMATELY CONSTANT. FOR EACH OF THESE GEOPHYSICALLY DISTINCT ROCK UNITS, DATA AVERAGED OVER

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DISTANCES OF ABOUT 100 METERS, SHALL BE PROVIDED CONCERNING PETROLOGY, DENSITY, SEISMIC VELOCITY, POROSITY AND PERCENT WATER SATURATION (FOR ROCKS HAVING A POROSITY GREATER THAN A FEW PERCENT). IF EXPLOSIONS ARE PLANNED NEAR THE BOUNDEARIES OF THE ADJACENT UNITS, THEN SIMILAR PHYSICAL PROPERTIES OF THE ADJACENT UNITS SHALL BE DSCRIBED OUT TO A DISTANCE OF SEVERAL TIME THE RADIUS OF THE CAVITY EXPECTED FOR EACH EXPLOSION.

CALIBRATION DATA

AN ADEQUATE PLOT OF YIELD VERSUS MAGNITUDE, USING THE MAGNITUDE SCALE OF THE SIDE PROVIDING THE DATA, FOR EACH GEOPHYSICALLY DISTINCT ROCK UNIT IN WHICH NUCLEAR EXPLOSIONS ARE TO BE DETONATED. THESE PLOTS MUST INCLUDE ACTUAL DATA POINTS FOR SEVERAL SHOTS. IN ADDITION, AN ADEQUATE NUMBER OF DATA POINTS IN EACH PLOT OF YIELD VERSUS MAGNITUDE, DATE, TIME, DEPTH, LOCATION AND DESCRIPTION OF THE CONTAINING MEDIUM FOR THE EXPLOSIONS CORRESPONDING TO THESE POINTS. THESE POINTS SHALL REPRESENT FULLY TAMPED EXPLOSIONS FOR WHICH THE YIELDS ARE WELL KNOWN AND SHOULD REPRESENT YIELDS NEAR THE AGREED THRESHOLD OR, IN ANY CASE, GREATER THAN 10 KT. THESE SHOTS SHALL HAVE BEEN FIRED SINCE THE BEGINNING OF 1967 AND SHOULD BE WITHIN ABOUT QP KNM OF FUTURE SHOTPOINTS. THE DESCRIPTION OF THE CONTAINING MEDIUM SHOULD IN CLUDE A GEOLOGICAL CROSS-SECTION TO 200 METERS BELOW THE SHOTPOINT OR TO BASEMETN, INDICATING EXPLORATORY HOLES AND METHODS USED TO OBTAIN DATA, AND A DESCRIPTION OF ROCK PROPERTIES FOR 200 METERS ABOVE XND BELOW SHOTPOINT, INCLUDING PETROGRAPHIC DESCRIPTIONS, DENSITY, SEISMIC VELOCITY, POROSITY AND DEGREE OF

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SATUARATION. WITH THIS DESCRIPTION THERE SHOULD BE A STATEMENT CONCERNING THE METHODS USED TO OBTAIN THE INCLUDED DATA.

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